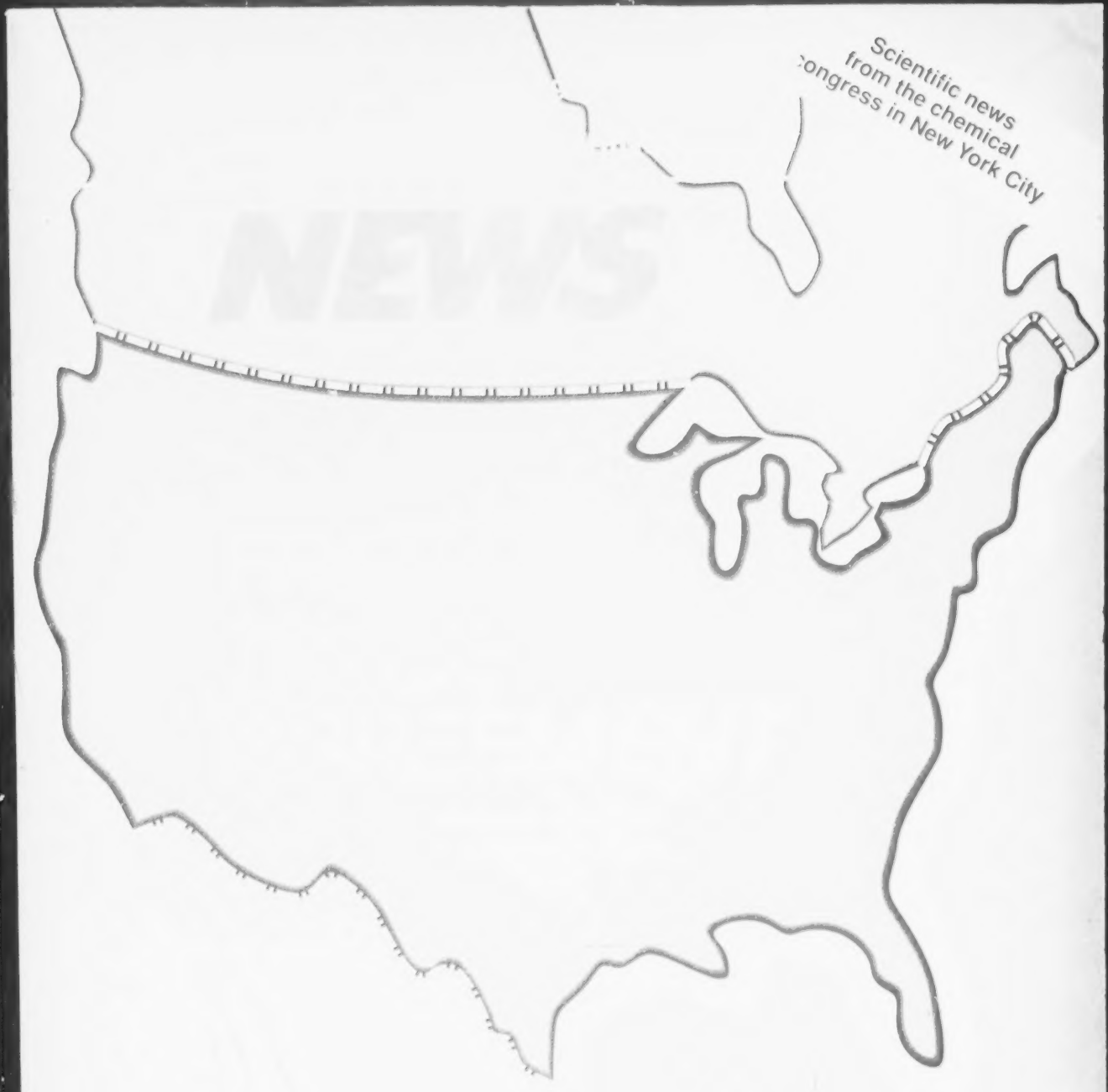
NEWS
Scientific news
from the chemical
Congress in New York City

CHEMICAL & ENGINEERING
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News of the Week

■ **Conference will convene this week in Geneva to review and strengthen the 1972 Biological Weapons Convention, which calls for wholesale banning of such arms.** Page 4

■ **Research satellite to study ozone, trace gases in the upper atmosphere is slated to be launched this week aboard NASA's space shuttle *Discovery*.** Page 5

■ **Cooperative agreement between Chemical Abstracts Service and Molecular Design will enable scientists to use a single system to access both in-house and public databases.** Page 5

■ **Chemical Abstracts Service director Ronald L. Wigington has been moved to a newly created post, and Clayton F. Callis, who is retired from Monsanto, will serve as interim director until a permanent replacement is found.** Page 6

■ **FDA committee has recommended approval for Centocor's monoclonal antibody for battling sepsis, but has delayed action on a similar product developed by Xoma.** Page 6

Business

First-half 1991 revenues up for most biotechnology firms despite almost all registering a drop in profits. **Page 17**

Government

From the New York chemical congress: OSHA's and EPA's regulatory responsibilities overlap, leading to a sometimes uncomfortable cooperation; Canadian, Mexican, and U.S. efforts to abate pollution discussed at symposium on environmental progress. **Page 21**

Science/Technology

From the New York chemical congress: Pressure to commercialize safe and effective chlorofluorocarbon substitutes is challenging chemical industry; thermochemical method classifies solid acids and bases; long-term predictions for pesticide market are mixed. In other news, report on catalysis in Belgium calls for multipronged approach to furthering education, training, and research in catalysis. **Page 27**

Education

Also from the New York chemical congress: Industry-academic partnerships promote science at the precollege level. **Page 40**

ACS News

Candid photos from the chemical congress give a glimpse of the plethora of activities and events in New York. **Page 42**

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News Focus

Mexico's chemical industry is readying itself for a possible North American Free Trade Agreement but faces some tough problems, especially the reins on investment, lack of integration in the petrochemical sector. Page 7

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LETTERS

Universal symbol for chemicals

In conjunction with efforts in planning a chemical-related workshop, the workshop committee couldn't find an acceptable symbol for chemicals that could be used in a workshop logo. It became uncomfortably clear to us that there was not a universally recognized symbol for chemicals. This is quite startling in as much as the nine-member committee, consisting of professional chemists, was unable to identify such a symbol.

In view of the number of practicing chemists and the importance and common place of chemicals in our everyday life, I've concluded there is a need for a universally recognized chemical symbol. I wonder if other ACS members have been confronted with this issue, and if it isn't an issue of sufficient importance and breadth that ACS should look into the matter further and possibly try to develop a chemical symbol that would become recognized and/or associated with chemicals by one and all.

John L. Cox
Staff Scientist, Chemical Process Development Section
Battelle Pacific Northwest Labs
Richland, Wash.

Project SEED

The letters responding to my Comment (C&EN, March 28, page 65) are greatly appreciated. Keith Symcox (C&EN, May 20, page 3) wondered if his difficulties in recruiting busy university faculty members to provide research opportunities for his high-ability students from low-income families are unique to metropolitan Oklahoma City. I can assure him that he is not alone.

Managing a high school student in a laboratory research project is not trivial. Even though Project SEED students are required to have completed a high school chemistry course so that they have at least minimal competence in the handling of chemicals, a successful project must be extremely focused and the preceptor must be prepared to help the student leapfrog to a conceptual grasp of its goal. Not everyone has the organizational and teaching ability required, and not all who do also have a strong desire to help young people from less fortunate circumstances. We hope that ACS members with the interest and ability to motivate these deserving high school students will respond in increasing numbers as the number of children living in poverty continues to grow.

Don Kennedy (C&EN, May 20, page 41) is among those for whom I did not make a couple of points sufficiently clear. First, when Erich Bloch compared Project SEED to a drop in the bucket, he was not referring to its financial support. Project SEED draws funds from many sources: donations from members, corporations, universities, ACS local sections and divisions, as well as federal funds from the National Science Foundation, the Department of Energy, and the Department of Labor. Kennedy raises the important point that programs that request funds must be accountable, and Project SEED enjoys a solid reputation as being exceptionally cost-effective [*Science*, **231**, 1053, (1986)].

Second, Project SEED is not a minority-focused program, although approximately half of all SEED students come from minority groups that are underrepresented in the scientific work force. However, since the science training pipeline contains relatively few children from families living in poverty, Project SEED's entire target population can be correctly seen as an underrepresented group in science.

Kennedy and other ACS members are the owners of Project SEED. It is important that members' pride of ownership of this worthwhile program continues to be expressed in terms of their support and participation as preceptors or contributors.

Edwin T. Harper
Indiana University School of Medicine
Indianapolis

Dangerous use of nylon resin

A rack for transporting lumber along the side of an automobile is pictured in your article on plastics (C&EN, June 10, page 39). This rack, which appears to project

Correction

• July 22, page 3: In the letter on boric acid, the Encyclopaedia Britannica reference should be 14th edition, not 4th edition.

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Mexico's Chemical Industry Gears Up for North American Free Trade

But government rules for both foreign and private investment and lack of integration in the petrochemical sector make chemicals a politically sensitive issue

Earl V. Anderson, C&EN Northeast News Bureau

Negotiations that could lead to a North American Free Trade Agreement (NAFTA) among Canada, Mexico, and the U.S. are under way. Industries of the three countries are jockeying for position to influence their country's negotiating strategy and goals.

Nowhere is this more true than in the chemical industry. In all three countries, the chemical industry has well-organized groups advising their respective governments on various aspects of NAFTA.

There are many NAFTA issues on which the chemical industries of the three countries probably can agree—but not on all.

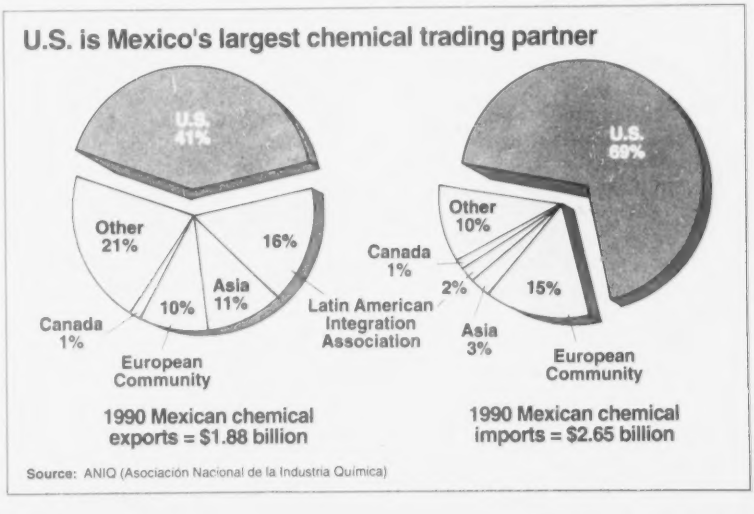
In many respects, what the U.S. chemical industry wants out of a trade agreement is different than what the chemical industry of Canada wants, which differs with what Mexico's chemical industry wants. In this first of a series of articles, C&EN examines NAFTA from the Mexican chemical industry's point of view. Future articles will examine NAFTA from the Canadian and the U.S. points of view.

Mexico is a developing country, but it's edging ever closer to industrialized status, says one Mexican economist. "Whether it wants to or not, Mexico will be part of the First World," says Jaime Serra Puche, Mexico's Yale-educated Secretary of Commerce & Industrial Development.

Actually, Mexico started heading in that direction in 1986. After pinning its economic hopes on the 1970s' oil boom, Mexico watched its economy collapse in 1982 along with world oil prices. Miguel de la Madrid Hurtado, then President of Mexico, started dismantling protectionist barriers that shielded inefficient Mexican industries and began opening up the windows of the Mexican economy to the fresh air of free-market competition.

He took a giant step in 1986, when he led Mexico into the General Agreement on Tariffs & Trade (GATT). Now his successor, Carlos Salinas de Gortari, is taking another giant step. He is leading Mexico into a possible North American Free Trade Agreement with the U.S., its elephantine neighbor to the north, and with Canada. The implications are enormous for Mexican industries. Its chemical industry is no exception.

Ever since government officials of the three countries became serious about negotiating NAFTA, chemicals—and particularly petrochemicals—have emerged as a "sensitive political issue." Few company officials, and even fewer government officials, agree to talk about it openly. Those who do choose their words carefully.



Getting legislative approval for NAFTA in Mexico

Like the U.S. Congress, the Mexican Congress will play a big role in approving and implementing any North American Free Trade Agreement (NAFTA). But the way the Mexican legislature goes about it will be much different.

For instance, the "fast-track" procedures in the U.S. mean that Congress must vote a trade agreement "up or down," with no amendments (C&EN, June 3, page 6). In Mexico, only the Senate approves a trade agreement. And it can make changes. The lower house, or Chamber of Deputies, cannot approve or disapprove a trade agreement. However, the Chamber will make its weight felt in shaping the implementing legislation. And some types of legislation must go through the Chamber before they reach the Senate.

In Mexico, a trade agreement such as NAFTA is legally an international treaty. Mexican constitutional provisions regarding international treaties would apply to NAFTA. The Mexican constitution gives President Carlos Salinas de Gortari the power to start, negotiate, and conclude international treaties. But, when agreement is reached, the deal has to be approved by the Mexican Senate, then ratified by the President and published in the Diario Oficial de la Federación, Mexico's counterpart to the U.S. *Federal Register*.

If the Mexican Senate makes any changes in the NAFTA accord, which is unlikely, the President will have to notify the U.S. and Canada of these changes. If the Senate votes down the agreement, which also is unlikely, the President will not be able to ratify it. If this does happen, though, it will not become law in Mexico, and the Mexican President will have to notify his trading partners of this turn of events.

However, once the Senate approves the agreement, with or without changes, it no longer has jurisdiction over it. The President then is free to ratify the agreement and to administer it. In addition, he has the power to terminate the agreement.

To comply with the terms of a NAFTA, Mexico may have to pass new legislation or amend existing laws. That's the job of both the Senate and the Chamber of Deputies. Senators, Deputies, or the President may introduce new bills. This legislation must be approved by a majority vote in both houses. Then it must be approved by the President and published in the official bulletin. If the President doesn't send a bill back to the originating body within 10 working days after receiving it, the bills are considered approved.

In the past, a rule of thumb in Mexico was that, if the President wanted it, the Senate and the Chamber would oblige. Although this is still more true in Mexico than in the U.S., NAFTA may very well run into some opposition in the Mexican legislature, particularly in the Chamber. Still, NAFTA probably will be approved in Mexico.

In June, the Chemical Manufacturers Association (CMA) released a series of position papers on NAFTA (C&EN, June 24, page 9). Its counterpart in Mexico, ANIQ (Asociación Nacional de la Industria Química) has completed its NAFTA position papers. But unlike CMA, it is keeping them secret.

Why this "political sensitivity?" The answer lies in Mexico, where that country's constitution and various laws have divided the petrochemical industry into two camps. One is the public sector, embodied in the government-owned oil monopoly, Petróleos Mexicanos (Pemex).

By law, production of all "primary," or basic, petrochemicals is reserved for Pemex. They are off-limits to private companies—domestic or foreign.

Private companies can produce all other petrochemicals that are not on the "primary" list. But, says Benito Bucay, "the fact is that we are talking of two [petrochemical] industries in Mexico." Bucay, who is assistant director of the Mexican firm Grupo Desc and a recognized leader in the Mexican chemical industry, adds that these two industries, no matter how closely they cooperate with each other, are in a difficult position to face fully integrated world competitors.

In the Mexican chemical industry, "integration" has become a buzzword. The lack of integration, from basic petrochemical feedstocks to downstream products, is one of the major factors coloring the Mexican chemical industy's approach to the NAFTA negotiations. The other is investment.

Because primary chemicals are off-limits to private investment, Pemex has to go it alone to raise capital for much needed new capacity in basic petrochemicals. But it has had trouble finding that capital.

According to Mexico's Petrochemical Commission, Pemex will need $1.7 billion between 1991 and 1995 to build the primary petrochemical capacity needed to meet demand. The secondary petrochemical industry must find an additional $1.5 billion.

The logical source for this capital is foreign investment. But neither foreign nor domestic companies can invest in the primary petrochemical sector. And foreign investment is limited to 40% in the secondary petrochemical sector. (There is now a "tertiary," or unregulated, petrochemical sector in Mexico, in which foreign companies can own 100% of a plant.)

This has led to a Catch-22 type situation. Without loosening the rules on foreign investment in general and, in particular on private investment in basic petrochemicals, Mexico won't have the money to build the capacity it needs. Hence, the integration that Mexico's petrochemical industry so sorely needs to become more efficient and more competitive in an increasingly open domestic petrochemical market, as well as in other world markets, will remain out of reach.

But Pemex's oil—and by extension its basic petrochemicals—are an emotional nationalistic symbol for Mexicans. Ever since Lázaro Cárdenas, one of Mexico's most revered presidents, nationalized the oil industry in 1938, Mexicans have been and still are very proud of the country's ownership of its oil resources. And the country's constitution guarantees that ownership.

To change the constitution that established this monopoly would be politically and socially dangerous. U.S. trade officials say they understand this. And Mexico's political leaders have told their people that oil will not be part of the NAFTA negotiations. But many Mexican nationalists still are convinced that NAFTA is just another attempt by U.S. companies to regain control of Mexican oil.

Several times since the start of the NAFTA negotiations, rumors have cropped up that the energy sector, including petrochemicals, would be part of the negotiations. Such rumors have consistently been denied by top Mexican officials. At NAFTA's ministerial meeting last month in Seattle, Wash., Mexico's Serra said that negotiations on energy and petrochemicals "will be totally respectful of the constitutional restrictions of Mexico."

Earlier this year, however, Serra made a distinction between primary petrochemicals, which are protected by article 27 of the Mexican constitution, and secondary petrochemicals, which are not. Secondary petrochemicals, accounting for 80% of Mexican petrochemical output, will be on the NAFTA negotiating table, he said.

As far as basic petrochemicals are concerned, there are ways to change the situation in Mexico without tampering with the constitution. Various laws and decrees have liberalized some aspects of basic petrochemicals in Mexico. In the past five years, many products that once were classified as primary petrochemicals have been reclassified as secondary products, making them accessible to private investment.

In 1986, Mexico switched 36 petrochemicals from its primary list to its secondary list. In 1989, it cut the list of primary petrochemicals reserved for Pemex from 67 to only 20 products. Since then, methyl *tert*-butyl ether (MTBE), the ever more popular gasoline additive, has been taken off the primary list. It now stands at 19.

With the addition of MTBE, there now are 67 products on the secondary petrochemical list. Private companies, as well as Pemex, can produce these products. And foreign investment up to 40% is allowed. In the tertiary, or unregulated sector, foreign investment can run up to 100%. Even in secondary petrochemicals, foreign companies can own more than the legal 40% maximum through a financial sleight of hand known as investment trusts.

Changing the classification of primary petrochemicals to secondary petrochemicals had one major goal: to lure more private investment into critical petrochemicals that previously had been off-limits and that Pemex had trouble supplying. The move was only partially successful in attracting private investment, particularly foreign investment. Private Mexican companies say Pemex still can't meet their demand for all of the products that Pemex alone makes in Mexico. Pemex, however, claims that it is fulfilling 90% of Mexico's demand for its products.

Recently, Pemex came up with what it calls novel financing schemes to attract the private capital—domestic and foreign—that it needs to complete two petrochemical plants and to start some others. But so far the amounts involved have been small.

With an eye on the need for a much greater degree of integration in Mexico's petrochemical industry and the foreign investment required to achieve it, one expert observer of the Mexican chemical scene says that, as far as chemicals are concerned, the free-trade negotiations will not be so much "trade" talks, as they will be "investment" talks. That undoubtedly is an oversimplification, but there's a huge element of truth in this statement.

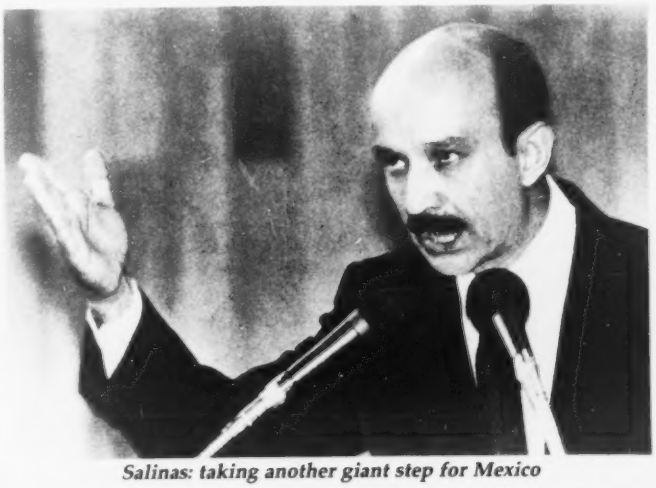
Certainly U.S. multinational chemical companies, a likely source of much of the foreign investment needed by Mexico's chemical industry, want access to Mexico's primary petrochemical sector—and more access than they now have to the secondary petrochemical sector. The Mexican chemical industry realizes that it needs this source of capital to finance the additional capacity that it needs and to promote further integration within the industry. But these wants and needs run smack into Mexico's constitution and national pride.

Little wonder, then, that petrochemicals have emerged as a politically sensitive issue in NAFTA negotiations. But for Mexico's chemical industry, NAFTA negotiations will be a lot more than petrochemical integration and investment. The industry's "statements of principles," or policy papers, reportedly cover no less than 18 different issues.

Actually, these policy statements are not ANIQ's, but were developed by the chemical industry committee that is advising Mexico's negotiating team. As in the U.S., Mexico has developed a series of public-sector advisory committees and, like in the U.S., these committees are loaded with acronyms.

The chemical industry advisory group in Mexico is Comité de Industria Química (CIQ). It is similar to ISAC 3, the industry sector advisory committee on chemicals in the U.S. Similar, but not exactly the same.

Leopoldo Rodríguez, who heads CIQ, says that his



Reuters/Bettmann photo

Salinas: taking another giant step for Mexico

group is a combination of a U.S. ISAC and the international trade committee of a trade association such as CMA, with a touch of the U.S.'s OCITA (Office of the Chemical Industry Trade Adviser) thrown in. The umbrella organization for all of Mexico's public- sector advisory groups is COECE—Coordinadora de Organizaciones Empresariales de Comercio Exterior. It, in turn, has formed a special working group, Coordinación Empresarial para el Acuerdo de Libre Comercio (CEALC), that focuses on NAFTA.

In Mexico, a host of confederations, associations, chambers, and councils look after the interests of various industrial sectors. More than a dozen of these national business groups make up COECE's membership. CIQ works closely with one of them—CANACINTRA, the Spanish acronym for the National Chamber of the Manufacturing Industry. In the other direction, it also works closely with the many trade associations of various sectors of the chemical industry, such as paints, inks, and plastics.

Rodríguez, who also is assistant director of the firm Industrias Resistol, says there is a "peculiar" reason why the chemical industry's position papers have not been made public. The Mexican chemical industry, he explains, is one of the few industries that understood from the start that NAFTA would be an "issues" negotiation and not a "product-by-product" negotiation.

Based on their experience in past trade negotiations, particularly within Latin America, Mexican industries became accustomed to product-by-product negotiations. The Latin American Integration Association, known by its Spanish acronym ALADI, is but one example of such negotiations.

Rodríguez explains that, because of this, COECE officials believed that early publication of the chemical industry's "issues-oriented" position papers might be detrimental to the interests of other Mexican industries. Thus the delay in making them public.

But he emphasizes that the chemical industry has no interest in keeping the position papers secret. It's not clear, however, exactly when they will be made public. Presumably, that should have happened by now. Rodríguez also stresses that Mexico's chemical industry wants to develop as many joint policy statements as possible with CMA in the U.S. and with the Canadian Chemical Producers Association (CCPA). Mexico's ANIQ already has produced two such statements with CMA. One supports "fast-track" legislation in the U.S. Congress (C&EN, June 3, page 6). The other recommends negotiating environmental issues parallel to, but not a part of, the NAFTA negotiations. ANIQ has issued no joint policy statements with Canada's CCPA yet. But that's primarily because Canada was a late starter in the NAFTA preliminaries.

There are many NAFTA issues upon which the chemical industries of the three countries can probably agree. There are some, no doubt, upon which they probably cannot. Rodríguez won't distinguish between the two.

But secrecy or no secrecy, some things are certain. One is that Mexico's chemical industry is an ardent NAFTA supporter. It sees NAFTA as a gateway to the world's largest single chemical market. It also believes that NAFTA affords the best opportunity to eliminate existing trade barriers to that market and to prevent future barriers from being erected.

Antonio Juarez Alvarado, petrochemical coordinator for Pemex's newly autonomous petrochemical division, says from a petrochemical point of view, Pemex "basically supports NAFTA." And, he adds, "we are not as apprehensive (about NAFTA) as the secondary petrochemical sector." But Eduardo Flores Magón, technical secretary of Mexico's Petrochemical Commission, says about 90 to 95% of companies in the secondary petrochemical industry favor the NAFTA negotiations.

Lars R. Christianson is very happy about NAFTA. Christianson, head of a small Mexican chemical company that bears his name, negotiated a lot of write-offs, shed the company's commodity products, and restructured the firm to concentrate on specialties, such as ethoxylates. With many U.S. and European companies interested in coming to Mexico, "we are the pretty girl at the party," says Christianson. His company is a strong acquisition candidate and he would be happy to have it acquired—"up to 50%."

Federico Ortiz Álvarez, director of Celanese Mexicana, says globalization of the world's economies and Mexico's new "open-market" approach "makes us actors in this process of change, whether we like it or not." And he believes that a free-trade agreement with the U.S. is the best alternative for guaranteeing the continued growth of the Mexican chemical industry, especially its exports.

The U.S. already is a good customer for Mexican chemicals—in fact, it's the largest single chemical export market by far. And the U.S. supplies most of Mexico's chemical imports.

Last year, the U.S. imported $665 million in chemicals from Mexico, according to U.S. Bureau of Census data. Using Mexican preliminary data, the figure is $772 million. The U.S. shipped $2.3 billion worth of chemicals to Mexico in 1990, according to U.S. data (Mexican data say $1.8 billion). But by any yardstick, Mexico is running a large chemical trade deficit with the U.S.

Only 19 products remain on list of primary petrochemicals only Pemex can produce

Ammonia	Pentanes
Benzene	Propylene
Butadiene	Propylene tetramer
Dodecylbenzene[a]	Raw material for carbon black
Ethylene	*tert*-Amyl methyl ether
Heptane	Toluene
Hexane	Xylenes
Methanol	*o*-Xylene
n-Paraffins	*p*-Xylene

a From propylene tetramer. **Source:** ANIQ (Asociación Nacional de la Industria Química)

Global chemical exports from Mexico hit almost $1.9 billion last year, up about 7% over 1989. More than 40% of that went to the U.S. Mexico's second largest chemical export market—ALADI—accounted for a distant 16% of Mexico's chemical exports. Only $10 million, a minuscule 0.5%, went to Canada.

The U.S. also supplied a lopsided 69% of all Mexican chemical imports, which totaled $2.6 billion in 1990. Canada, on the other hand, supplied less than 1% of Mexico's chemical imports. Mexico had a chemical trade deficit of just over $1 billion with the U.S. alone last year. But its overall chemical trade deficit was only $769 million. That's because it was able to run up large chemical trade surpluses with ALADI countries, Asia, and some other countries.

Mexican chemical leaders want to correct that chemical trade deficit, especially the lopsided deficit with the U.S. But other indicators paint the Mexican chemical industry as much less than equal to its large counterpart in the U.S. Chemical shipments in the U.S. last year were a hefty $285 billion. Mexican chemical sales, at about $13 billion, are only 5% as large. Average sales per worker in the U.S. chemical industry are $162,000. In Mexico, they're only $91,000. This elephant-mouse relationship reflects the tremendous competitive pressures that Mexico's chemical industry faces in an open-market environment. As a result, the industry is trying to be very realistic in analyzing the NAFTA negotiating process.

Mexico's chemical industry is understandably concerned about many issues that are certain to come up in the NAFTA talks. Investment ranks high on the list, but there are many others. Among them: tariffs, market access, intellectual property rights, rules of origin, dispute settlement procedures, and a host of others.

Rodríguez cautions that, although Mexico's chemical industry supports NAFTA, it must make certain that the "right things for our industry" are negotiated. Only if they are will the industry continue supporting the negotiations and their outcome.

Much, he says, depends upon finding some degree of what he calls "complementarity" between the Mexican chemical industry and those of the U.S. and Canada. This does not mean divvying up production among the three countries such that, for example, the U.S. produces all of the polyethylene, Canada all of the polyvinyl chloride, and Mexico all of the polypropylene for the NAFTA region. Such an arrangement, says Rodríguez, has not worked well in Latin America in the past. Nor are the Mexican chemical trade advisers thinking as simplistically as that. However, they can't go into detail publicly about what they are thinking, says Rodríguez.

U.S. chemical production dwarfs Mexico's . . .

Top 50 rank[a]		1990		1989		% change 1989–90	
		Mexico	U.S.	Mexico	U.S.	Mexico	U.S.
		(thousands of metric tons)					
1	Sulfuric acid	3974	40,171	4026	39,282	−1.3%	2.3%
4	Ethylene	1370	17,001	1188	15,853	15.3	7.2
6	Ammonia	2632	15,386	2555	14,842	3.0	3.6
7	Phosphoric acid	na	11,045	677	10,646	na	3.7
8	Sodium hydroxide	429	10,605	428	9,517	0.2	11.4
9	Propylene	366	10,034	295	9,176	24.1	9.3
10	Chlorine	387	9,925	382	10,356	1.3	−4.1
11	Sodium carbonate	448	9,004	456	8,995	−1.8	0.1
12	Urea	na	7,171	512	7,226	na	−0.7
13	Nitric acid	na	7,031	310	7,575	na	−7.2
14	Ammonium nitrate	na	6,446	106	7,140	na	−9.7
15	Ethylene dichloride	394	6,033	357	6,205	10.4	−2.7
16	Benzene	320	5,380	291	5,294	10.0	1.6
18	Vinyl chloride	231	4,831	194	4,364	19.1	10.8
19	Ethylbenzene	192	4,078	149	4,182	28.9	−2.5
20	Styrene	158	3,638	120	3,688	31.7	−1.4
21	Methanol	210	3,624	208	3,239	1.0	11.9
22	Terephthalic acid	279	3,488	276	3,769	1.1	−7.4
23	Formaldehyde	na	2,908	112	2,889	na	0.7
25	Toluene	368	2,767	344	2,649	7.0	4.5
26	Xylene	404	2,586	391	2,631	3.3	−1.7
27	Ethylene oxide	265	2,531	208	2,413	27.4	4.9
28	*p*-Xylene	226	2,359	222	2,490	1.8	−5.3
30	Ammonium sulfate	na	2,263	390	2,127	na	6.3
31	Hydrochloric acid	na	2,123	282	2,880	na	−26.3
32	Cumene	53	1,955	50	2,059	6.0	−4.9
33	Acetic acid	144	1,706	132	1,737	9.1	−1.8
35	Phenol	36	1,592	34	1,765	5.9	−9.8
36	Propylene oxide	0	1,452	0	1,452	0	0
37	Butadiene	21	1,433	21	1,402	0	2.0
38	Acrylonitrile	122	1,374	85	1,184	43.5	16.1
39	Carbon black	125	1,302	118	1,320	5.9	−1.5
40	Vinyl acetate	51	1,157	53	1,120	−3.8	3.1
41	Cyclohexane	75	1,120	54	1,084	38.9	3.3
43	Acetone	55	1,007	56	1,134	−1.8	−11.1
47	Sodium sulfate	496	667	604	685	−17.9	−2.9
48	Isopropyl alcohol	19	626	18	649	5.6	−3.6
48	Caprolactam	71	626	62	594	14.5	5.2

. . . and the story is the same for plastics

Polyethylene, low density	348	5,071	340	4,400	2.4	15.3
Polyvinyl chloride[b]	292	4,123	288	3,847	1.3	7.2
Polyethylene, high density	176	3,778	97	3,674	81.0	2.9
Polystyrene	130	2,273	125	2,313	4.0	−1.8
Polypropylene	0	3,774	0	3,284	0	14.9

a Based on C&EN's Top 50, April 8, page 14. b Includes copolymers. na = not available. Sources (for Mexican data): Pemex, ANIQ (Asociación Nacional de la Industria Química)

But it is not too difficult to surmise what they are thinking. Mexico's petrochemical industry has two distinct characteristics: It has a shortage of basic petrochemicals; yet, it has a surplus of downstream products such as synthetic fibers, plastics, resins, and elastomers, which it exports. In the so-called secondary petrochemicals sector, as much as 25%—even 50%—of some products are exported. Much of it goes to the U.S.

On the other hand, the Mexican chemical trade advisers see the U.S. petrochemical industry with a surplus in some basic products. This, coupled with a concentration of petrochemical plants running along the Gulf Coast from Baton Rouge, La., to the Isthmus of Tehuantepec, should leave ample room to find some degree of complementarity.

Tariffs, of course, are part of any trade negotiation, and NAFTA will be no exception. But, as a result of many multilateral negotiations held by GATT, most U.S. chemical tariffs already are low. Mexico lowered many of its tariffs when it joined GATT in 1986, but they generally are higher than those in the U.S.

Five years ago, Mexico's average tariff (not just chemicals) was about 40%. Now it's between 10 and 13%. In the U.S., the average tariff on Mexican products is less than 4%. But on some products, U.S. tariffs are exorbitantly high. Mexican shoes, for instance, are slapped with a 73% duty, and the duty on Mexican textiles is 37.5%.

About 42% of the $665 million worth of chemicals that the U.S. imported from Mexico last year entered the country duty free under the Generalized System of Preferences (GSP). For several chemical sectors, the percentage was well over 70%. Under the GSP program, the U.S. grants duty-free treatment to imports from qualified developing countries. Mexico is one of those countries. The U.S. chemical industry wants NAFTA to eliminate all chemical tariffs in stages over a period not to exceed five years, with longer staging for import-sensitive products. And, because it believes that the petrochemical industries of both countries have "similar levels of sophistication," it wants the staging schedules to be the same for both countries.

The Mexican chemical industry doesn't object to eliminating tariffs. But it's unlikely that the Mexican petrochemical industry buys the "similar level of sophistication" argument. Indeed, many of Mexico's industrial leaders, in and out of the chemical industry, want the NAFTA accord to specifically acknowledge their country's lower level of economic development. And they want Mexican industries to get a longer phase-in period for tariff reductions than U.S. industries do. Indeed, a transition period that is acceptable to all sides probably will be a key factor in the success of the negotiations.

Juarez: Pemex basically supports pact

If chemical tariffs were completely eliminated, GSP would be meaningless for Mexican chemical exports to the U.S. But until those tariffs are completely eliminated, GSP privileges will remain important to the Mexican chemical industry, and it probably will fight to retain them.

According to Rodríguez, the Mexican chemical industry's interest in tariffs goes well beyond chemicals. What it wants is to improve the competitiveness of domestically produced downstream products manufactured by companies that are the chemical industry's customers. Textiles are a good example. Mexican textiles face not only high tariffs in the U.S., but quotas as well.

"Our [tariff] concern is not narrow," says Rodríguez. "It encompasses the entire industrial chain." The reason is obvious. If its domestic customers are more competitive in regional and world markets, sales of the Mexican chemical industry rise.

In fact, the Mexican chemical industry would like to see downstream customers in all three NAFTA countries become more competitive against other world regions, such as Asia and Europe. "A rising tide will raise all ships," says Rodríguez.

While welcoming Mexico's drive to open its markets to foreign competition, many Mexican chemical companies are nevertheless worried about the increased competition they are getting from imports, particularly from the U.S. One chemical company official says, "What we used to call 'our' domestic market is not what it used to be as a result of imports." And he cites a "special situation" that is increasingly hurting his company and others like it.

His example: A U.S. chemical company has one customer with a 100 ton-per-month order and another with only a 10 ton-per-month order for the same product. Naturally, the larger customer gets a preferential—that is, lower—price. In Mexico, he says, there aren't many 100 ton-per-month customers, but there are many customers in the 10-ton category. These smaller customers are getting imports from the U.S. at the same price as the 100 ton-per-month customer in the U.S.

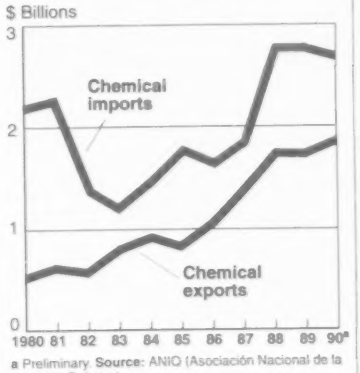
This, he says, is not dumping in the legal sense of the word. But he considers it unfair and hopes that the NAFTA talks can do something about it.

Another problem facing Mexican chemical companies stems from what he calls "the developing country system of standards" in Mexico. Downstream custom-

ers in Mexico import, at very low prices, products that would be considered substandard in the U.S. These imports compete with prime-grade products made in Mexico.

So why don't Mexican chemical companies make substandard products to meet the demand of their domestic customers? It's not that simple. No chemical company, U.S. or Mexican, makes substandard products on purpose. And, as this Mexican chemical executive points out, if only 3% of production in the U.S. is substandard, that's a lot. If 3% of Mexican production is substandard, it doesn't amount to much. This problem, he says, is common throughout the entire Mexican secondary petrochemical industry.

Mexican chemical exports have grown rapidly



a Preliminary. **Source:** ANIQ (Asociación Nacional de la Industria Química)

He also considers this type of import competition unfair, even if it may not be unfair in the legal sense. Either way, its impact is very real for many Mexican chemical companies. One solution, of course, is for Mexico to raise the standards that downstream Mexican customers must meet. The unspoken hope is that the NAFTA talks will provide the impetus to do just that.

Industrias Resistol's Rodríguez says that there are also situations in which import competition is fair, but still hurts many Mexican chemical companies. During Mexico's long romance with protectionism, for instance, Mexican chemical companies tried to achieve economies of scale by concentrating their product lines in a very few products. For example, 99% of Mexico's plasticizer requirements were met by dioctyl phthalate alone.

Now that Mexico has opened its economy to foreign competition, these Mexican companies are finding it difficult to compete with the wide variety of products flowing into the country. Rodríguez says that the Mexican industry will have to diversify. But it won't be easy.

What can the trade talks do about such fair, but still tough, competition? Rodríguez emphasizes he does not want to see Mexico raise barriers to fair competition. But he hopes the trade negotiations will be able to increase awareness of what he calls "these gray areas," particularly when the competition comes from non-NAFTA countries.

Different chemical companies in Mexico have different pet peeves along with their high hopes about NAFTA. But no one fails to bemoan the lack of integration in the petrochemical industry and the private, especially foreign, investment needed to achieve it.

Eduardo Prieto, director of the Mexican firm Grupo Primex, says simply that Mexico's hydrocarbon resources are one of its major advantages. Its lack of petrochemical integration, he adds, is one of its major disadvantages. Fernando Sada of Celulosa y Derivados S.A. (Cydsa), noting the high degree of integration in the U.S. petrochemical industry, says the distinction between the private sector and government-owned Pemex prevents that kind of integration in Mexico.

Tomás Rodríguez of Celanese Mexicana says that integration is indispensable for Mexico's petrochemical industry. And he lists what could happen if the industry doesn't achieve it:

- Industry growth will be limited.
- It will continue to depend on imports.
- Its trade balance will be adversely affected.
- The entire Mexican economy will be adversely affected.
- Inflation will result from higher import prices.
- Export capacity will be limited.
- It will not be able to develop higher value-added products.

Celanese Mexicana's Ortiz concedes that some attempts have been made in the past to bring Pemex and the private secondary sector closer together. But, he adds, these attempts haven't achieved enough. "We should not speak of a public sector and a private sector," says Ortiz. "We have to think and act as a single, integrated sector—as one national petrochemical industry."

He cites Pemex's new petrochemical division, an autonomous unit operating separately from Pemex's much larger and domineering oil interests, as a "significant step" in the right direction. Not only have the dialogue and cooperation between the two sectors improved since the new division was formed, says Ortiz,

Many Mexican chemicals enter U.S. under Generalized System of Preferences

SITC No.[a]	Category	1990 U.S. chemical imports from Mexico ($ millions) Duty free[b]	Other	Total	% duty free
51	Organics	$ 93	$ 63	$157	59.2%
52	Inorganics	35	202	236	14.8
53	Dyeing, tanning, and coloring materials	16	23	39	41.0
54	Medicinals and pharmaceuticals	5	10	15	33.3
55	Essential oils, toilet preparations, polishing materials	34	11	44	77.3
56	Fertilizers	0	15	15	0
57	Plastics in primary form	23	8	31	74.2
58	Plastics in nonprimary form	56	20	76	73.7
59	Other	18	33	52	34.6
5	TOTAL	$280	$385	$665	42.1%

Note: Some totals may not add due to rounding. a Standard International Tariff Classification. b Under GSP (Generalized System of Preferences). **Source:** U.S. Bureau of the Census

but the division has been able to come up with novel financing schemes—ways for Pemex to attract the private investment it needs to bring on stream some of the much-needed new primary petrochemical capacity.

In Mexico's petrochemical industry, it is virtually impossible to separate the word "investment" from the word "integration." Investment in Pemex's primary, or basic, petrochemicals is the key to new investment in the entire petrochemical industry. Pemex's basic petrochemicals are the raw materials for the secondary petrochemical sector. And those raw materials are a prerequisite for investment, not only in secondary petrochemicals, but in sectors further downstream.

"We have a serious financial problem," admits Pemex petrochemical coordinator Juarez. To entice private sources, including foreign companies, into supplying some of the $1.5 billion it needs to complete planned projects, Pemex is experimenting with what he also calls novel financing schemes. These schemes allow private capital to flow into the primary petrochemical sector without violating the constitution.

Pemex already has used this approach to finish two plants at its Morelos petrochemical complex. It used about $10 million from Cydsa to finish an acrylonitrile plant. This same approach was used to complete the Morelos acetaldehyde plant, with $15 million coming from Celanese Mexicana. Both companies will be paid back with product from the new units.

Whether these methods will work for some of Pemex's larger proposed projects remains to be seen. Pemex detractors say they won't work for proposed projects that require huge chunks of capital. Among them: $600 million for an aromatics complex, $450 million for a new ethylene plant, and perhaps $350 million for MTBE capacity.

But Pemex apparently isn't discouraged by its detractors. Reportedly, French and German companies are interested in building—and financing—at least some of these major petrochemical projects. Their return on investment would come from renting the units back to Pemex for a specified number of years. After that time, Pemex would become the owner of the units.

The aromatics complex, which Pemex plans to build at its Cadereyta refinery, will be huge. Juarez says that the complex probably will include a 140,000 metric ton-per-year benzene unit, as well as plants to produce 400,000 metric tons of *p*-xylene, 18,500 metric tons of toluene, 54,000 metric tons of mixed xylenes, and 41,000 metric tons of *o*-xylene, along with all of the auxiliary units that accompany an aromatics complex of that size.

Pemex also plans to build another ethylene plant. This one will be built in the state of Tabasco and will have a capacity of 500,000 metric tons annually. It also is looking at several options for MTBE. The company may opt for one large MTBE plant or build several smaller units.

But first, says Juarez, Pemex wants to finish its much-delayed propylene plant at Morelos. Earlier this year, the company came on stream with Mexico's first polypropylene plant, also located at Morelos. But Pemex needs additional propylene capacity to replace the propylene that it has been importing. The company hopes to have its Morelos propylene unit on stream by the end of next year.

No one, not even Pemex, knows how successful these investment approaches will be. If they fall short of what Pemex needs, it or the government will have to come up with new ways to attract private capital into the primary petrochemical sector.

One possibility: reclassify even more primary petrochemicals as secondary products. Industrias Resistol's Rodríguez doubts if this approach will succeed. "We have already done a lot of that, and it hasn't been good enough," he says. But some Mexican petrochemical experts advocate pushing Pemex's petrochemical role all the way back to naphtha. Private companies would take over the rest of the petrochemical chain, from naphtha cracking downward through the remainder of the petrochemical stream. This would open up more of Mexico's petrochemical industry to private, as well as foreign, investment. And it would help spur the integration that the industry wants so badly.

Referring to the structural changes that have engulfed the global petrochemical industry over the past few years, Nicolás Guitiérrez Montero, director of Grupo Novum's Quinonas Division, says, "We can't keep doing what we've been doing for decades." The process of change is too radical for that, he adds, and only "equally radical changes" will make the Mexican chemical industry competitive.

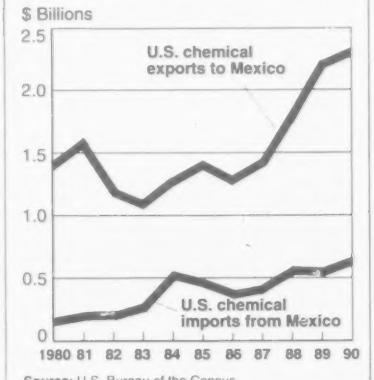
Perhaps what the Mexican chemical industry really is hoping for is that NAFTA will provide those radical changes or, at least, emerge as a stimulus for them. Virtually every government and business leader in Mexico concedes that Mexico needs foreign investment to sustain its recent economic growth.

But capital for foreign investment is scarce. Many developing countries are competing for it. Eastern European countries are just the most recent examples.

Mexico must compete for it, too. Chemical company president Christianson says that you can't talk about good investment without having a good economic climate. This good climate, he says, will come out of NAFTA.

Indeed, NAFTA may be the best guarantee that Mexico will ever have of obtaining its share of foreign investment. Properly executed, it would go a long way toward restoring foreign investors' confidence in the Mexican economy. □

U.S. runs huge chemical trade surplus with Mexico



Source: U.S. Bureau of the Census

Revenues Grow For Biotech Firms But Few Show Profitability

Promise of revenue growth based on product approvals led to surge in biotech stocks despite lack of profits in the first half of 1991

Ann M. Thayer,
C&EN Northeast News Bureau

The first half of 1991 started on an upbeat note for biotechnology companies. A few product approvals in late 1990 and early 1991—the first since mid-1989—started people thinking again about blockbuster products and the potential for soaring revenues. Biopharmaceutical firms were optimistic about prospects for Food & Drug Administration approvals, the stock market was bullish on biotechnology stocks, and stock offerings were plentiful. All this activity occurred, with biotechnology stocks out-performing the overall stock market, despite the limited profitability among biotechnology companies.

In general, stock prices rose throughout the first quarter. Buoyed by a product approval and favorable patent decision, Amgen's stock rose from about $60 per share to about $126 per share. Trading for about $160 per share, a 3-for-1 stock split takes effect this month. On the losing side of the patent battle, Genetics Institute's stock fell about 50% after having gained the same amount in the first quarter.

Other companies, such as Biogen, Centocor, Cetus, Chiron, Immunex, and Xoma had steady growtn in stock prices in the first quarter. Most such increases were tied to successful or anticipated product approvals. But for Cetus, an FDA advisory committee's refusal in 1990 to recommend approval of one of the firm's products meant the company's stock fell from over $22 to under $8.00 per share before prices rose in the first quarter of 1991 and remained near $1[illegible] per share. Stocks of Genentech, Repligen, Genzyme, and Synergen remained relatively constant over the first half of the year.

This same trend has prevailed for agricultural biotechnology stocks. The exception is Ecogen, which is the primary factor behind the rising ag biotech stock index. Ecogen's financial outlook blossomed with several strategic partnerships, an infusion of capital, and growth in revenues. Its stock bounced back from a low of about $1.75 per share at the beginning of the year to trade now at about $10 per share.

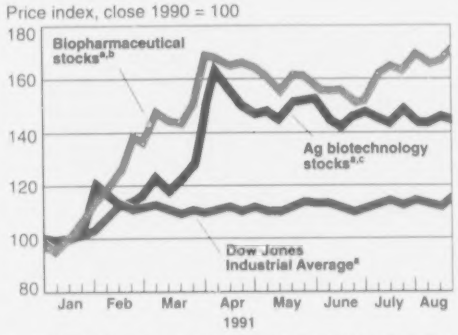
Before stock prices generally dropped slightly and then leveled off in the second quarter, companies were eager to raise capital through stock offerings. Many were extremely successful but, since then, the glut of offerings has led to others being canceled. A noteworthy initial public offering was held by Regeneron and brought in about $91 million, twice what was expected. Antisense company Isis Pharmaceuticals also went public and raised $36 million.

About the same time as its product was approved, Genzyme held a secondary offering that brought in $143 million. Synergen similarly raised $95 million and Xoma $86 million. In secondary offerings, California Biotechnology, Cytogen, Enzon, Gensia, Immunogen, and Liposome all raised between $30 million and $40 million each, whereas T Cell Sciences and Calgene both raised about $20 million. Ecogen has a $13 million offering under way. Despite canceling a sale of its own stock, Genetics Institute raised about $43 million through an offering in a new research subsidiary, SciGenics.

Although revenue growth averaged more than 50% for the 34 companies surveyed by C&EN, only a handful have product sales or are profitable. Applied Bioscience, Biogen, Chiron, and Immucor continued to show a profit for the first half of 1991 as they did at the end of 1990. Amgen and Collagen dropped from the ranks of the profitable, but Genentech and Genzyme showed profits.

Two companies that recently turned the corner to profitability, Biogen and Chiron, continued along that route. Biogen had increased royalties from expanding sales of α-interferon as well as from its diagnostics licensees. The strong performance of Chiron's diagnostics joint venture with Ortho Diagnostics contributed to

Biotechnology stocks rising faster than overall market



a Reindexed to show relative change. Prices as of Friday's close each week. b Based on stock prices for Amgen, Applied Bioscience, Biogen, Centocor, Cetus, Chiron, Cytogen, Genentech, Genetics Institute, Immunex, Repligen, and Xoma. c Based on stock prices for Calgene, Crop Genetics, DNA Plant Technology, Ecogen, and Mycogen.

Only six biotech firms showed a profit in first-half 1991

	FIRST-HALF 1991					
	Revenues[a]	Earnings	Change from 1990		Profit margin[b]	
	($ thousands)		Revenues	Earnings	1991	1990
BIOPHARMACEUTICAL						
Amgen	$293,391	$ −11,508	128%	def	def	14%
Biogen	35,331	5,151	24	54%	15%	12
BioTechnology General	2,172	−3,752	24	def	def	def
California Biotech	4,539	−3,895	−21	def	def	def
Cambridge Biotech	13,164	−1,324	28	def	def	def
Centocor	24,510	−116,504	−17	def	def	0
Cetus	27,336	−35,804	21	def	def	def
Chiron	52,328	9,555	64	def	18	def
Cytogen	2,235	−9,523	−12	def	def	def
Genentech	261,407	30,724	12	65	12	8
Genetics Institute	26,277	−21,177	48	def	def	def
Genex	969	−1,799	−59	def	def	def
Gensia Pharmaceuticals	1,329	−14,311	nm	def	def	def
Genzyme	48,103	6,944	115	def	14	def
Immunex	24,565	−3,683	11	def	def	8
Immunogen	839	−5,800	40	def	def	def
Isis Pharmaceuticals	3,495	−3,116	5361	def	def	def
Liposome	3,707	−2,293	83	def	def	def
MGI Pharma	3,858	−4,859	36	def	def	def
Nova Pharmaceuticals	25,020	−7,526	169	def	def	def
Oncogene Science	3,968	−631	45	def	def	def
Regeneron	5,300	−1,474	488	def	def	def
Repligen	5,302	−2,872	−7	def	def	def
Ribi ImmunoChem	626	−1,581	−12	def	def	def
Synergen	8,335	−3,642	43	def	def	def
Xoma	10,053	−14,717	−14	def	def	def
AGRICULTURAL						
Crop Genetics	1,028	−2,878	282	def	def	def
DNA Plant Technology	5,214	−6,613	−26	def	def	def
Ecogen	3,467	−2,850	228	def	def	def
Mycogen	7,179	−1,804	−3	def	def	def
OTHERS						
Applied Bioscience	53,378	5,778	15	−6	11	13
Celgene	916	−3,204	37	def	def	def
Collagen	31,710	−5,448	23	def	def	8
Immucor	12,200	1,724	87	52	14	17

a Includes product sales, contract research, royalty, and interest revenues for first half of calendar year. b After-tax income as percentage of sales. def = deficit. nm = not meaningful.

its 18% profit margin, the highest of any company in the first half of the year.

Genentech's earnings reached $31 million on revenues of $261 million. Product sales for tissue plasminogen activator (TPA) and human growth hormone (HGH), and the recently approved γ-interferon, totaled $197 million. Revenue growth of 12% was due primarily to HGH sales. TPA sales dropped because of the release in March of the results of a major European study of competing blood clot dissolving agents. TPA's market share dropped in the second quarter from 60% to 53% and is expected to remain at about 50%. Sales are estimated at $180 million for 1991 as compared with more than $200 million in 1990.

The early April 1991 approval of Genzyme's Ceredase, although not currently produced by recombinant means, increased product sales 87% in the first half and the company reported a profit. With revenues up 115% to $48 million, Genzyme is confident of reaching its goal of $100 million in revenues for 1991.

Despite leading the industry with revenues of $293 million for the first half, a $129 million charge against earnings caused Amgen to report a deficit. The charge is part of a $164 million settlement with marketing licensee Ortho Biotech related to sales of erythropoietin. Without the charge, profits for the first half would have been $77 million. The company's second product, a granulocyte colony-stimulating factor (G-CSF), launched in early 1991, contributed about 25% to product sales.

Immunex's granulocyte macrophage CSF was approved in March and contributed to growth in product sales. However, for the half year, the company reported a loss because of increased expenses in expanding its sales, marketing, clinical, and scientific staff. Similarly, Centocor's loss of about $117 million resulted in part from investment in sales and marketing in the U.S. and Europe and a $70 million charge for acquired R&D. In the first quarter, the company's monoclonal antibody product for treating sepsis received a recommendation for approval in Europe.

Other big losses were reported by Genetics Institute and Cetus. Genetics Institute's resulted partly from an $11 million charge against earnings related to a patent suit against Amgen. Genetics Institute expects to be profitable in the second half of 1991. Cetus had increased revenues because of interleukin-2 sales in Europe and from its polymerase chain reaction technology, but reported a loss of $36 million for the first half. In July, Cetus and Chiron agreed to merge. Another older biotechnology firm to be acquired was Genex, purchased by Enzon in June.

On the agricultural side, biotechnology firms in general reported limited revenues and losses in the first half. The biggest turnaround was for Ecogen, although not yet profitable, with revenues tripling and product sales doubling over the same time last year. Yet the biggest event for this part of the industry was Mycogen's receiving Environmental Protection Agency approval of the first two genetically engineered microbial pesticides in early July. □